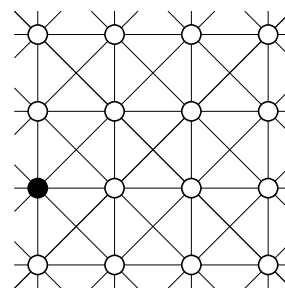


WISCONSIN MATHEMATICS, SCIENCE & ENGINEERING TALENT SEARCH

PROBLEM SET I (2012-2013)

October 2012

1. Find all positive integers n such that n^3 and n^4 contain, between them, each of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 exactly once.
2. Let ABC be an acute triangle with median BD and altitude CE , where $BD = CE$ and $\angle DBC = \angle ECB$. Show that ABC is equilateral.
3. We color each point of a unit cube with one of three colors. Is it true that there are necessarily two points in the cube with the same color with distance at least 1.4? How about 1.5?
4. Let m, n be integers such that 23^{2011} divides $m^2 + n^2$. Show that 23^{2012} divides mn .
5. Consider 16 lattice points arranged on a 4×4 square grid. We color the first point of the third row black and the other 15 points with white. Next in each step we can choose a horizontal or a vertical line or a line which is parallel to one of the main diagonals and we can change the colors of the lattice points on that line to the opposite. Is it possible to change the colors of all the lattice points to white?



You are invited to submit a solution even if you get just one problem. Please do not write your solutions on this problem page. Remember that solutions require a proof or justification.

Return To	MATHEMATICS TALENT SEARCH Dept. of Mathematics, 480 Lincoln Drive University of Wisconsin, Madison, WI 53706 talent@math.wisc.edu	Deadline November 1, 2012	
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